RUSSIAN EXPECTATIONS

BACKGROUND

Hardware and Service Capabilities

Having assumed responsibility and control for a major portion of the Soviet fleet, Russia's space launch capability is a near mirror reflection of that of the former Soviet Union.

The former Soviet Union developed and maintained a diverse fleet of space launch vehicles and supporting infrastructure. Most of the launch vehicles, derived from the SS-6, were based on technology developed from the German V-2 rocket. The Soviets began to develop space launchers by making adjustments to existing vehicles and then developed newer vehicles to increase lift capacity and support missions not achievable with current systems. Not only did the Soviets rely on proven technology for vehicle design, they also dispersed mission roles to a large number of vehicles. Ten different boosters were used for launch purposes including the workhorses of the Soviet fleet, the Kosmos, Soyuz and Proton boosters. Although these vehicles appeared initially between 1959 and 1968, the Soviets continued to rely on basic booster designs and well-tested technology.

The wide variety of rocket boosters provided space launch services for a broad range of uses -- communications, navigation, meteorological, and remote sensing satellites along with planetary probes, science experiments and manned space flight. The Soviet space launch fleet had supported both military and civilian users, with the primary focus being military. (Up to an estimated 70% of Soviet launches were military in nature).

Current Russian Space Launch Vehicles

Ten space launch vehicles currently are used to satisfy space launch requirements. Six of the ten are derivatives of ballistic missile boosters. The other four, SL-12, SL-13, SL-16 and SL-17, were developed specifically for use as space launch vehicles.

The Russians have offered to make available the following rocket boosters for space launch services:

Current:	Energia, Proton, Vostok/Soyuz/Molniya, Kosmos, Cyclon (Tsiklon), sounding rockets.
Planned:	ICBMs (SS-18, 19, 24, 25) SLBMs (Vysota, Volna, Shital) Burlak

[redacted]

Energia (US Designation - SL-17)

Developed by NPO Energia, the Energia launch vehicle provides Russia with an unparalleled heavy lift capability (40,000 lbs to GEO). With only two launches to date, the Russians still consider it to be a pre-operational system. The second test flight in November 1988 placed an unmanned Buran space orbiter in space. There are reportedly at least three flight-ready Energia systems at Baikonur. Its primary mission are LEO and GEO payloads and the Buran shuttle. Reportedly dependent upon a subsystem and component supplier base of over 500 enterprises, the Energia/Buran systems will clearly be impacted by the changes taking place in the Russian space industry -- especially in terms of reliability for delivery and reliability of product and cost. Energia launch vehicle has been grounded for nearly four years for lack of funds. The Energia-M is hoped to replace the Proton.

Proton (US Designation - SL-12, SL-13)

The Proton is the only current Russian launch vehicle capable of delivering satellites to GTO and GEO. It can deliver satellites directly into GEO (up to 4,850 lbs). The Proton is the launch vehicle currently bid to launch one of the INMARSAT-3 satellites. It can also be used to launch LEO payloads and support interplanetary missions. A Proton launched this summer carrying a Gorizon communications satellite indicates that the Proton heavy booster operations continue to be healthy despite the Russian program slowdown.

Krunichev is building currently eight Protons, but its facility can provide twice that number in a year according to Aleksandr Lebedev, Deputy Director General at Krunichev. In order to maintain a production line, Krunichev needs to build at least six Protons annually, he added.

One senior Russian official said June 11, 1992, that his country could be very competitive since a Proton currently costs about $600,000 to build. The low cost is attributable in part to labor rates in Russia.

Vostok / Soyuz / Molniya (US Designations - SL-3, SL-4, SL-6)

All three launch vehicles are based on SS-6 technology developed during the 1950s. Sharing the same core stage and strap-ons, the Vostok, Soyuz, and Molniya launch vehicles are the most widely used in the former Soviet inventory, accounting for approximately 60% of the launches. Over 40 of the launch vehicle series were launched every year during the 1980s. Today, the Vostok supports LEO missions; the Soyuz supports all manned flights and recoverable photographic reconnaissance/remote sensing satellites; and the Molniya supports communications and early warning satellites.

Kosmos (US Designation - SL-8)

Also based on ICBM technology (SS-5), the Kosmos is the smallest launch vehicle in the Soviet inventory. It supports low altitude navigation and other LEO satellites. It is the only launch vehicle capable of being launched from all three former Soviet launch facilities.

Cyclon (US Designation - SL-11 and SL-14)

Based on SS-9 ICBM technology, there are two versions of the Tsiklon -- the SL-two-stage version not available for commercial use, and the Sl-14, a three-stage version introduced in 1977. This second version has been the most widely used over the past decade, supporting LEO missions dealing with meteorology, remote sensing, communications, science, and electronic intelligence. With its highly automated launch preparation system, pre-pad horizontal launch and payload integration, and the unmanned, robot-supported launch vehicle erection and fueling, it is reported to be ready for launch 60-90 minutes after arrival at the pad.

Proposed Russian Launch Vehicles Based on Surplus Missiles

Plans to convert former Soviet ICBMs and SLBMs into suborbital and orbital launch vehicles focus primarily on small payloads. From the ICBM inventory, SS-18s, SS-19s, SS-24s and SS-25s all are the subject of plans to convert these military assets into commercial revenue-generating goods. The SS-N-8, SS-N-18 and S-N-23 SLBMs are also being considered for commercial space launch purposes.

Under U.S.-Russian arms agreements, while silos need to be destroyed by 2000, launch vehicles do not. As warheads are separated from ballistic missiles and destroyed, the missiles can be salvaged and converted into launchers capable of lifting communications and remote-sensing satellites into low orbit.

SS-18

There are currently 204 SS-18s in existence. It is the most powerful ICBM (largest throw weight) developed in the USSR. Initial discussions have begun between DOE and Russian officials on using the SS-18 rockets to launch environmental remote-sensing satellites.

SS-19 (Rokot)

SS-19, whose SLV label is "Rokot", has a payload capability one-half of the SS-18. The most advanced in its conversion, the Rokot is intended to be used for microgravity payloads, LEO satellites, and "ship rescue capsules." A test flight was performed in December 1991. The price quote for launch is about $6 million.

SS-15 (Start-1)

START-1, which is based on the SS-25 ICBM, is planned to be used for launching small microgravity payloads into LEO. It is designed by the Moscow Institute of Thermal Processes and is produced by the Votkinsk Maching Building Plant. It is air transportable and road mobile. The first test flight is scheduled for late 1992. Its price tag has been reported in the press to be around $3.5 million per launch.

SS-24 (Space Clipper)

Space Clipper, based on SS-24 technology, is a plan for an aircraft-launched launch vehicle. The SS-24 was developed by NPO Yuzhnoye and produced at its Pavolgrad Mechanical Plant. The START Treaty bans new basing modes for current ICBMs. While the idea for the Space Clipper exists only on paper, it would have a payload capacity ranging from below the Scout class to above the current Pegasus capability. Prices quoted in a recent KB Yuzhnoye business plan ranged from $6 to $16 million.

SLBMs

While any converted SLBMs would have a much more limited payload lift capacity, plans are being considered to convert the SS-N-8 (Vysota), SS-N-18 (Volna) and SS-N-23 (Shital). Their primary application would be for microgravity platforms. No price for any of the proposed vehicles is known.

Burlak

Burlak is a liquid-fuel launch vehicle launched from the Tu-160 Blackjack heavy bomber.

Russian Launch Facilities

There are three launch facilities currently available to the Russians: Baikonur/Tyuratam, Plesetsk and Kapustin Yar. Baikonur, which is the southern-most launch facility, is located in Kazakhstan while the other two are situated in the Russian Federation.

Baikonur/Tyuratam

Baikonur/Tyuratam, which is located at 45.6 degrees N, is the only facility in the CIS used for the launch of manned missions, geosynchronous satellites and lunar/interplanetary flights. All former Soviet vehicles, except the SL-14, can be launched here. It is the only facility that currently has the capability for the Proton, Zenit and Energia launch vehicles. There are at least 10 pads at the launch site. The U.S. launch facility equivalent would be Cape Canaveral.

Since the dissolution of the Soviet Union, shaky relations between Russian and Kazakhs over use of the Baikonur Cosmodrome have developed. At a July 25, 1992 press conference, Kazakh military and civilian spokespeople hurled insults at a high-ranking Russian space delegation. The Kazakhs' main complaints are that they do not have enough say in the management of Baikonur, and that they do not share in the launch profits. A May agreement signed by each Republic's president stipulated that Kazakhstan will receiver 15% of the profits from the sale of Mir visits to international customers.

The cost to operate Baikonur before the Soviet Union's breakup, according the Russian officials, was 3 billion rubles ($20 million at current exchange rates). In the May 1992 agreement, Russia agreed to pay 94 percent of Baikonur's operating costs. Kazakhstan will pay 6 percent.

Plesetsk

Plesetsk, located at 62.8 degree North, is the most northern and busiest launch site of the three. It serves as the facility for polar orbiting satellites and other unmanned missions. Plesetsk is the current launch site for the Soyuz, Molniya, Kosmos and Cyclon launch vehicles. Because of a highly automated system to erect and launch space vehicles, it is capable of performing a higher launch rate than Bikonur with significantly fewer personnel. The U.S. equivalent would be Vandenberg.

Kapustin Yar

Kapustin Yar, sited at 48.8 degrees North, is the oldest former Soviet launch facility (built after World War II) and is the least used. US launch facility equivalent would be Wallops Island.

Russians as Space Launch Service Providers

This July, U.S. Government and industry officials were given the opportunity to visit and assess Russian space capabilities. Select comments on the Russians' capabilities are as follows: "They build robust equipment...They have a good range of very capable and effective liquid engines which appear to be well-made...Clearly, their metalworking and those kinds of skills that we could see were very good."

Although most of the systems were designed almost 30 years ago, they are still capable of providing reliable and cost-effective service in this decade. As of December 1990, the success rate of a total of 2079 Russian space launches was 96.3%. This long-term success rate is consistent with recent launches as well. Out of nearly 600 space launches from the beginning of 1985, only 22 have failed as a result of launch vehicle malfunction, a 96% success rate. While the success rate remains high, the number of launches has declined precipitously. Russian plant managers have indicated that there are significant slowdowns in orders. Demand for missiles, boosters, and spacecraft in the CIS is down by about 50%, according to estimates. Prior to 1989, there were on average between 80 and 100 launches a year. In 1990, there were just above 80 launches. In 1991, 59 launches took place. As of July of this year, there were 23.

Rapid decreases in quality control within space-related facilities have increased concerns about the ability to produce rockets of the same caliber as in the past. One Russian engineer recommended that if one was interested in acquiring Russian space hardware, the most reliable equipment is not the newest nor the oldest hardware in stock but rather that which had been built under the Soviet regime but before massive economic reforms were introduced.

Demand for Launches

The commercial launch services market averages between 12 and 15 completed launches annually and is valued at over a billion dollars. The number of commercial launches on DOT's manifest has grown from 20 in mid-1989 to 51 currently. At present, U.S. companies are averaging about six launches per year. With Arianespace capturing more than 60% of the current market, even a constrained entry now of the Russians will make it much more difficult for US companies. Any unconstrained entry will preempt market suppliers' competitiveness..

With the introduction of such small satellite projects as Iridium, the number of launches by the end of the century is estimated to be about 24 but could go as high as three times that number.

Plans for small satellites are proposed by the Russians as well. The Gonets system, using the 300 MHz range of the spectrum, proposes to consist of a 36-LEO constellation for high-speed data communications.

Yet, while there are plans for additional satellite launches, there are also potential new suppliers for this payload category. Besides the United States, France, Russia and the PRC, Japan is nearing configuration design freeze of a new solid rocket booster, the J-1, intended to place 1-ton payloads into LEO.

Marketing Efforts to Date (Including Cape York and INMARSAT)

The producers of space launch vehicles have stepped up considerably their efforts to market launch services and boosters since they first began this endeavor in the mid-1980s. They are offering most of their operational launch vehicles and also have proposed developing several new vehicles, contingent upon Western financial backing. As primary selling points, they have emphasized their ability to provide reliable, inexpensive launch services with short leadtimes from their existing launch facilities. In some cases, space officials offered to sell the launch vehicles and ground support equipment as well as to assist in the development of launch facilities in foreign countries. The benefits sought through these ventures have included international prestige and influence; technology acquisition; exposure to more advanced information and operations practices; and most importantly, hard currency. Russia's space officials hope that the infusion of hard current will keep production lines open, maintain R&D capabilities, and retain skilled labor.

Existing Russian space launch capability could capture the entire international commercial launch market. Russian space industry officials propose using launch vehicles for space transportation; microgravity and biological experiments; and delivering supplies to disaster areas.

Prices for Russian space-related goods and services are cheaper than those in the West. KB Salyut, which designs the Proton launch vehicle, bid to launch an INMARSAT-3 satellite in the mid-1990s for $36 million (plus $9 million for integration and other expenses), which was about 30% lower than the bids by U.S. and European competitors. NASA is considering purchasing the Energia rocket to shuttle components of Space Station Freedom into orbit. Cost per launch is estimated to be about $500 million. Converted missiles are also cheaper than Western launchers. According to Vladimir Gorbuline, the Director General of the Ukrainian Space Agency, an SS-18 with a retrievable capsule would cost between $20-40 million.

While Russia is actively seeking possible deals with foreigners, the effort is not one-sided. According to Aleksandr Lebedev, Deputy Director General at the Krunichev Enterprises, more than 15 possible customers, ranging from US and European companies to South Korea, have expressed interest in buying Proton launch services.

[redacted]

Other international space-related activities include:

[redacted]

- Austria

  Astronaut has flown on Mir.

- France

  Astronauts have flown on Mir.

[redacted]

- India

  Launch services for remote sensing satellite.

[redacted]

- Pakistan

  Offer to launch Pakistani satellite.

- South Korea

  Proposed launch services for domestic communications satellites.

[redacted]

In the end, Russia's ability to act effectively in the market will be influenced by such issues as: the stability of the infrastructure; launch vehicle reliability; distribution channels; costs and pricing; and access to the international market.

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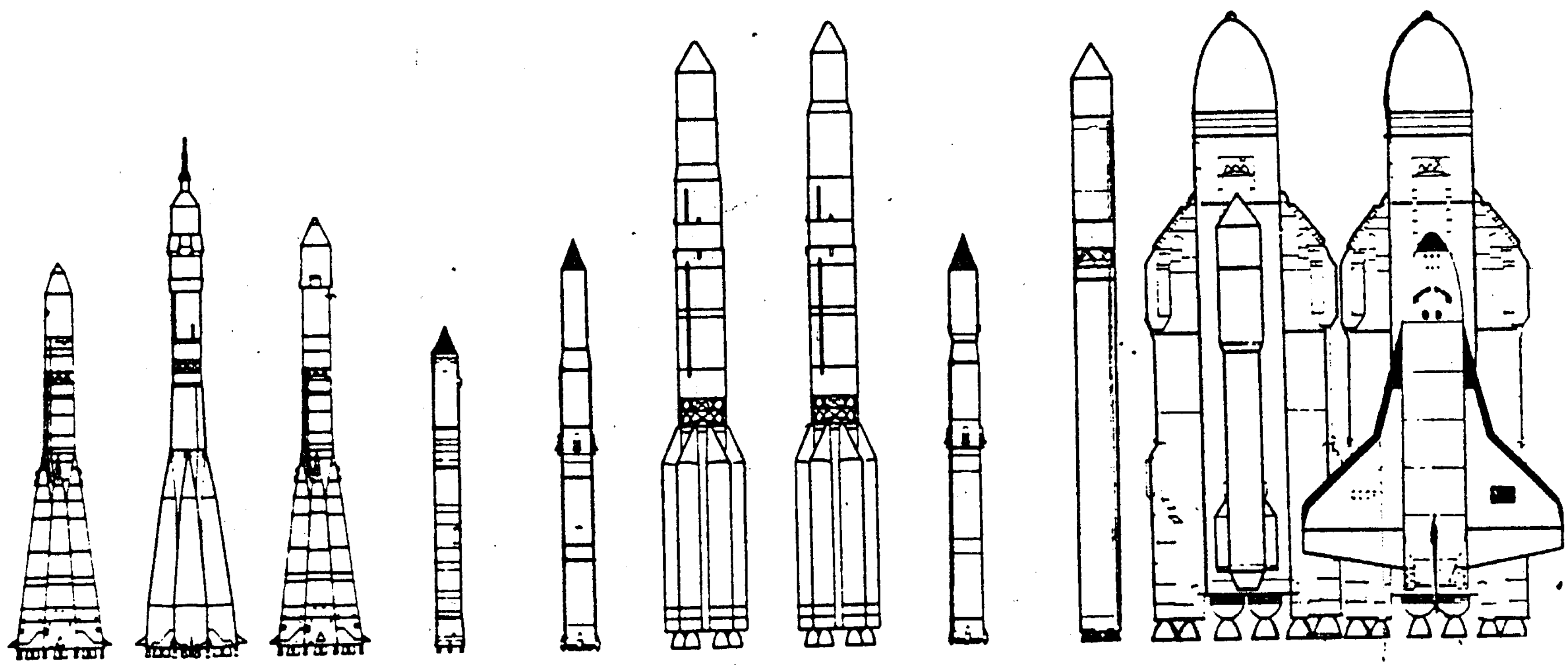
Figure II.D-2
Soviet Launch Vehicles



lame	SL-3 (Vostok)	SL-4 (Soyuz)	SL-6 (Molniya)	SL-8 (Kosmos)	SL-11 (—)	SL-12 (Proton)	SL-13 (Proton)	SL-14 (Tsyklon)	SL-16 (Zenit)	SL-17 (Energiya)	SL-17 (Energiya/Shuttle)
)perational	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
irst Launch	Jan 59	Nov 63	Oct 60	Aug 64	Sep 66	Mar 67	Nov 68	Jun 77	Apr 85	May 87	Nov 88
leight (m)	38.36	49 52	45.23	31.2	39 27	57.2	59 8	44.0	61.4	58 7	58 7
)iameter (m)	2 95	2 95	2 95	2 4	3 0	4 2	4.2	3.0	3.9	8.0	8.0
'ayload Capability (kg)	4,730 (LEO)	7,240 (LEO)	1,800 (Polar)	1,500 (LEO)	4,000 (LEO)	2,200 (GEO)	20,600 (LEO)	4,000 (LEO)	13,740 (LEO)	105,000 (LEO)	30,000 (LEO)
;uccess (%) (thru 12/90)	98.1	99.4	86.7	98.9	98.3	86.8	84.6	98.9	86.7	100	100

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Table II.D-2
Soviet Launch Vehicle Reliability
(Through December 1990)

Vehicle	Success	
SL-3 (Vostok)	158 of 161	= 98.1%
SL-4 (Soyuz)	943 of 949	= 99.4%
SL-6 (Molniya)	235 of 271	= 86.7%
SL-8 (Kosmos)	368 of 372	= 98.9%
SL-11 (---)	114 of 116	= 98.3%
SL-12 (Proton)	138 of 159	= 86.8%
SL-13 (Proton)	22 of 26	= 84.6%
SL-14 (Tsyklon)	86 of 87	= 98.9%
SL-16 (Zenit)	13 of 15	= 86.7%
SL-17 (Energiya) - 1987	1 of 1	= 100%
SL-17 (Energiya/Shuttle) - 1988	1 of 1	= 100%
	Total: 2079 of 2158	= 96.3%

MULTIPURPOSE SPACE COMPLEX "CONVERSION"

Lavochkin Association.

The conversion of space industry is a state concept of:

- humanization of intellectual activity of high-qualified scientists and engineers;
- usage of high scientific potential of defense industry in field of national economy;
- justification of defence industry expenses.

"CONVERSION" is a multipurpose space complex being developed in accordance state concept of conversion. The space complex is being developed on base of:

- the "SS-18" intercontinental ballistic missile;
- on-board systems and equipment of existing spacecraft;
- existing ground complexes for spacecraft preparation, launch and control.

The "CONVERSION" space complex consists of the modified "SS-18" booster with the "Freight" multipurpose orbital module, spacecraft preparation complex, the ground facilities of a booster tracking, the ground mission control complex.

The modification of three-staged "SS-18" means that the third military stage has been replaced by the "Freight" multipurpose orbital module. The "Freight" module is space platform used for the acceleration during a payload injection. Besides it supports orbital maneuvering and operating of a payload.

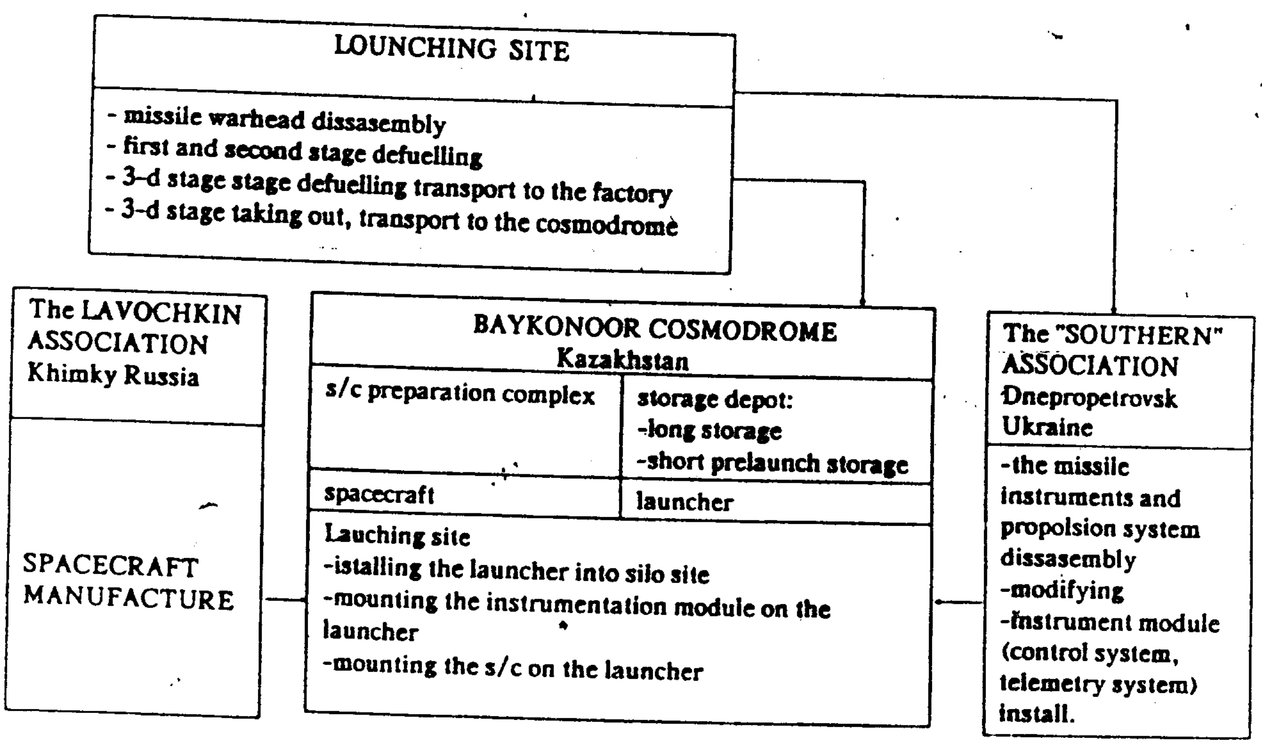
The silo-launched "SS-18" booster is fired from Bakonoor.

Two waste stages of the booster don't litter the terrestrial space for they fall into their touchdown zones. The booster may be launched towards 65 deg. - azimuth, besides to form a sun-synchronous orbit 98 deg. - azimuth.

The "Conversion" multipurpose space complex offers partners the following services:

- the payload maintenance at preparation and launching complexes in the customer's presence;
- the payload injection into an orbit of 200 ... 1,500 km altitude;
- the payload orbital operating support (control, telemetry, thermoregulation, power supply);
- manoeuvres of the orbit correction, small terrestrial satellites putting into different points of the orbit;
- re-entry of the payload capsule installed in the orbital module.

Once exiting elements are used in the "Conversion" complex we expect its space services to be 20 % lower than the world market prices. The "Conversion" space complex will be exploited commercially by a joint-stock company. Investors are invited to be members of the joint-stock company.



THE CONVERSION OF "SS-18" BOOSTER